IMPROVING $PORT PERFORMANCE ON $ARCH

PLATFORM-BASED PERFORMANCE TUNING OF WEBKIT (PORT=QT ARCH=MIPS74KF)

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WHOAMI

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THE CHALLENGE

MAKE A QTWEBKIT-BASED BROWSER USEABLE ON LIMITED HARDWARE

MIPS 74Kf @500 MHz
RAM: 256 MB
No GPU

MIPS74KF

“Classic” MIPS32

+

FPU

+

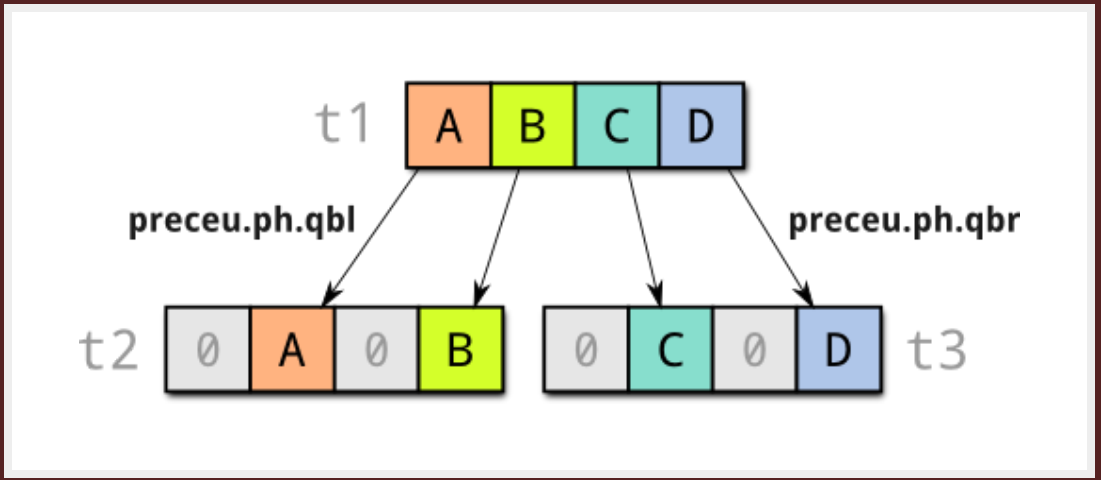
MMU

+

DSP

DSP?

No. Not really a DSP.



Intructions suitable for signal processing.

THE PLAN

PROFILE → OPTIMIZE → VALIDATE

WHAT TO OPTIMIZE

Video/audio decoding.

Image operations.

WHERE TO OPTIMIZE

Can we improve the platform overall,
not just WebKit?

Yes!

QtWebKit uses the Qt drawing functions.

A/V decoding uses GStreamer, which uses Orc.

Good candidates for SIMD code.

LIMITATIONS

No Valgrind.
No GDB.
No `perf`.
No performance counters.

↓

qemu + `gdbserver`.
`gperftools`.
`CLOCK_PROCESS_CPUTIME_ID`

ROLL YOUR OWN TOOLS

(WITH HELP FROM EXISTING ONES)

GNU HAMMER^WTIME!

```
# Use full path to avoid using the shell's time builtin
# One line per run with user/system time and page faults
/usr/bin/time -a -o timings.txt \
    -f '%U %S %F %x %C' $COMMAND

# For example, measuring the qtdemux GStreamer component
/usr/bin/time -a -o timings.txt \
    -f '%U %S %F %x %C' gst-launch -q \
    filesrc=file.mp4 ! qtdemux ! video/x-h264 ! fakesink
```

TIMING

Beware of CLOCK_PROCESS_CPUTIME_ID's resolution!

```
#define CLOCK_MAX_RESOLUTION_DELTA  (10000.0 * 1e-9)
bool usePosixClock() {
    static bool checked = false;
    static bool useposix;
    if (!checked) {
        if (posixClockAvailable()) {
            double res_theorical = posixClockTheoricalResolution();
            double res_empirical = posixClockEmpiricalResolution();
            useposix = fabs(res_theorical - res_empirical)
                <= CLOCK_MAX_RESOLUTION_DELTA;
        } else {
            useposix = false;
        }
        checked = true;
    }
    return useposix;
}
```

clock.cc

WEBSNAP

```
% g++ -DMAIN -o clock clock.cc
% ./clock
CLOCK_PROCESS_CPUTIME_ID is supported
Resolution (advertised/empirical): 0.0000000010/0.0000002460s
Sampled resolution: 0.0000005470s
Printing the lines above took 0.0000483550s
```

```
% LD_PRELOAD=/usr/lib/libprofiler.so \
    ./websnap http://igalia.com 1000 pprof
Loading 100% Layout completed
Load successful
libprofile.so detected (0x7f77468e8f90, 0x7f77468e8fd0), output 'pprof'
Profiling started, code: 0x1, timeout: 0
PROFILE: interrupts/evictions/bytes = 634/537/22168
http://igalia.com 1000 6.2709987870s
```

```
% mkdir out && ./runtests 1000 < urls.txt
```

github.com/aperezdc/websnap

...AND BEYOND

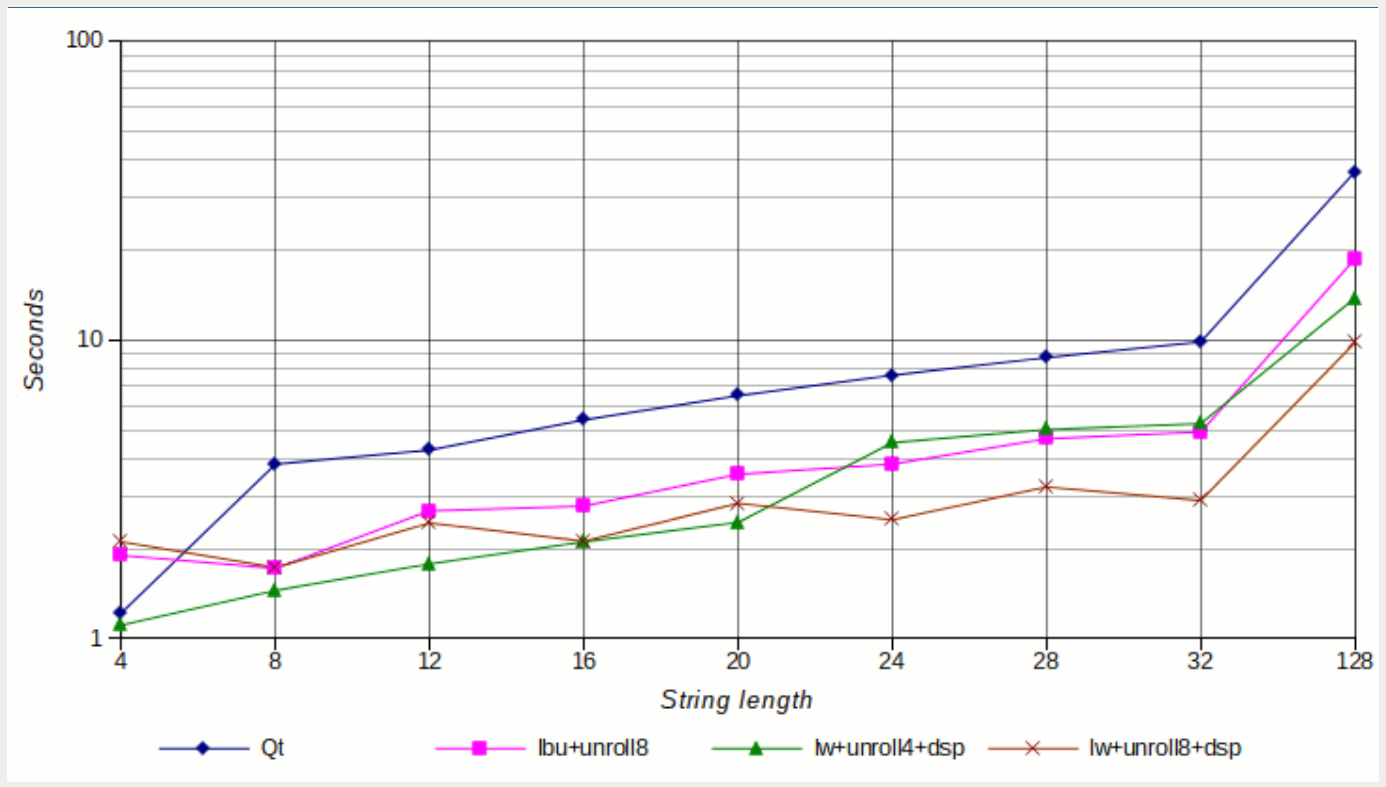
Ad-hoc Python/Bash scripts:

Fix library paths in profiler output.
Data munging.
Measurements comparison.
Generate CSV files.
Report generation.
…

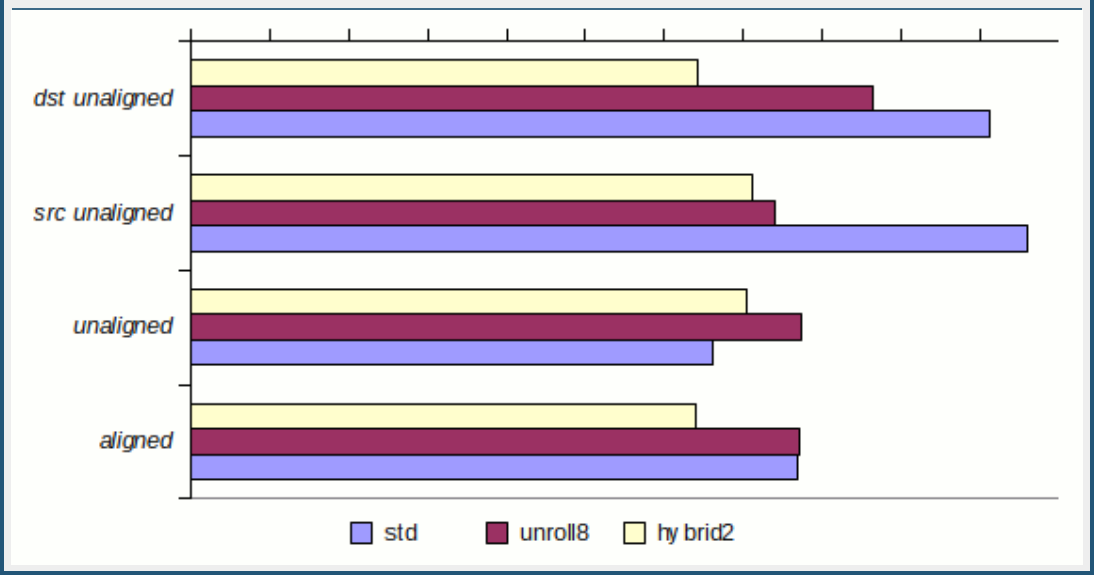
SOME RESULTS

(DETAILED)

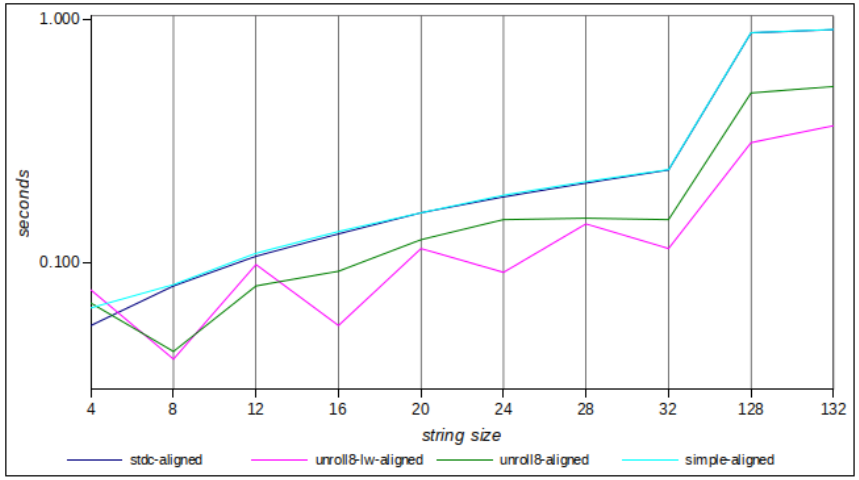
LATIN-1 → UTF-16

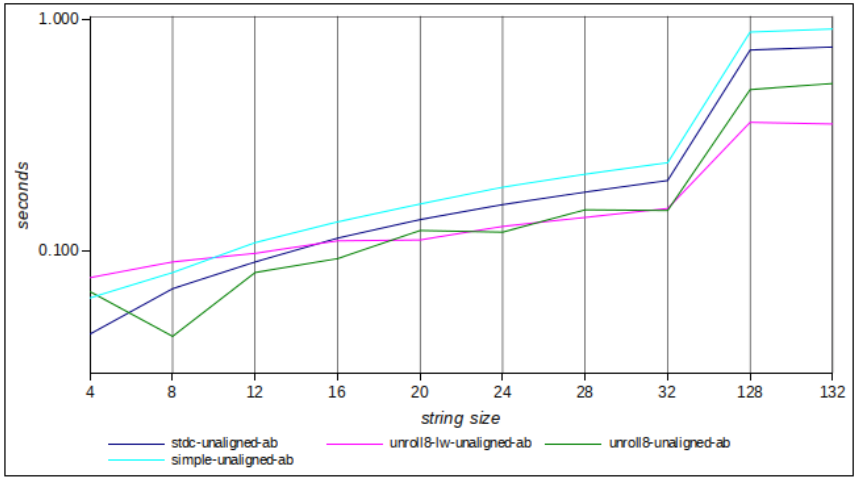


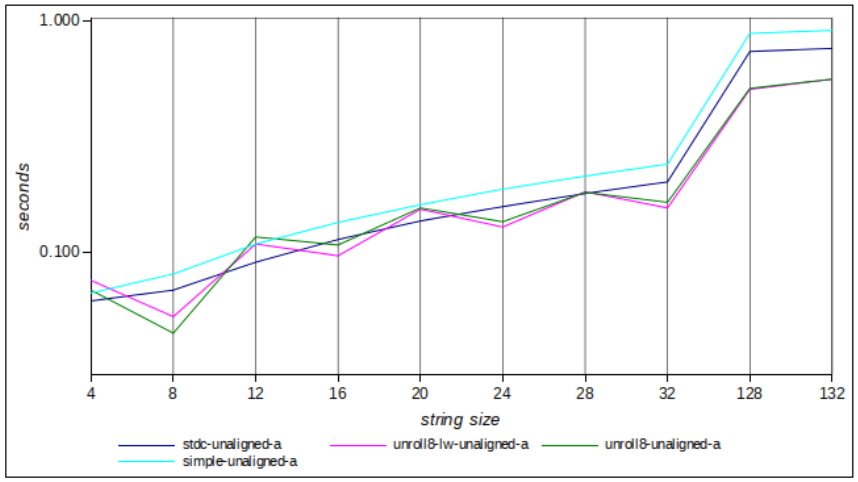
ALPHA BLENDING

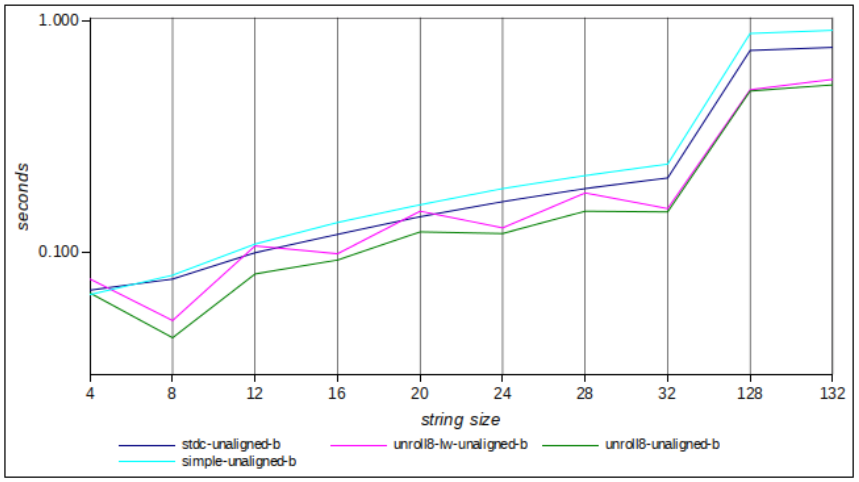


UTF-16 STRICMP()

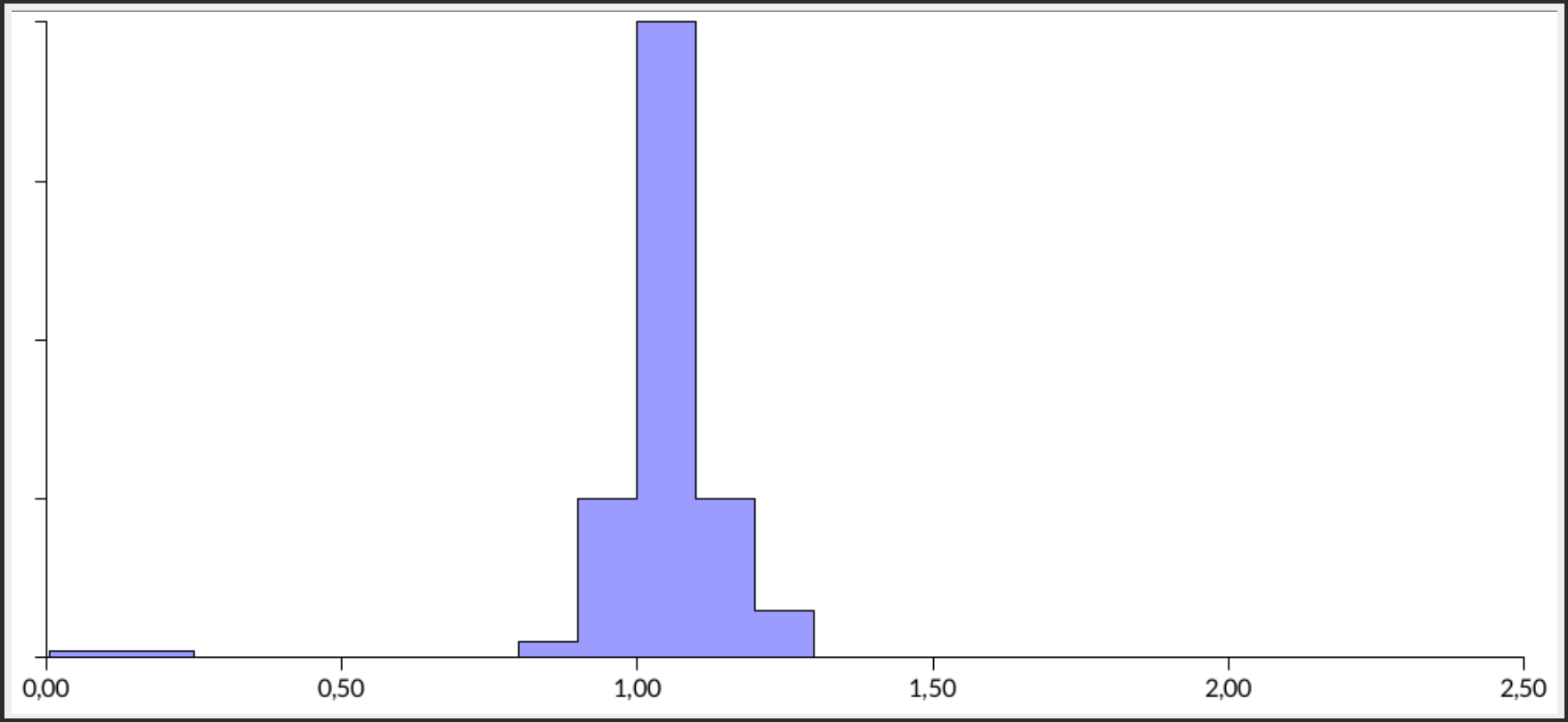








RESULTS

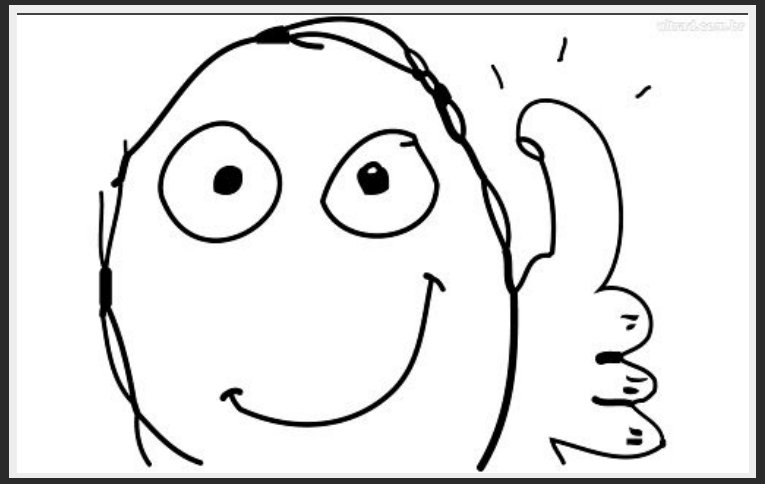


Speedup histogram

UP TO 30% FASTER RENDERING

Thanks to:

Orc backend using MIPS DSP instructions
`QImage` composition operations
Color conversion (RGB16/888 → ARGB32)
Alpha premultiplication and blending
String conversions and comparisons



UPSTREAM STATUS

Orc backend complete upstream

Initial work based on Qt 4.8

Most of the code is already in Qt 5.2

Rest in the next release

No backport to Qt 4.8


THANK YOU
FOR YOUR ATTENTION
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